

WHAT IS CLAIMED IS:

1. A method of manufacturing a metal pipe body by bending a flat metal plate at predetermined angles, comprising the steps of:

5 bending a portion near at least one end of the plate along an axis of the completed metal pipe body so as to have a predetermined angle of a corner of the completed metal pipe body;

10 bending the same side as said bent portion of said metal plate at points which correspond to some integer times of one side of the completed metal pipe body in the same bending direction as said bent portion along the axis of completed metal pipe with an angle more than said predetermined angle;

making one of the portion made by said second bending, concave toward the center of completed metal pipe body;

15 pressing portions including edges of the plate towards the center of completed metal pipe body along the bottom surface of said portions including edges so as for said edges to get close contact and at the same time modifying said angles more than the predetermined angle into said predetermined angle;

generating a modifying operation of said concave portion into convex form toward outside against center of the completed metal pipe accompanied with said angle modifying operation;

20 accumulating inner stress for said concave portions tending back to said convex form through said modifying operation by making said concave portions flat thereby making a close contacting operation of said portions including edges by operation for all sides other than said convex portion and portions including edges enforcing towards the center of completed metal pipe; and

25 maintaining said edges contacting together and said originally concave portion flat.

2. A method of manufacturing a metal pipe body by bending a flat metal

plate at an angle, comprising the steps of:

bending a portion of the flat metal plate near at least one end of the flat metal plate along an axis of the completed metal pipe body so as to have a predetermined angle of a corner of the completed metal pipe body;

5 bending the same side as said bent portion of said metal plate at points which correspond to some integer times of one side of the completed metal pipe body in the same bending direction as said bent portion along the axis to be completed metal pipe with an obtuse angle more than said predetermined angle;

10 making one of the portion made by said second bending, concave toward the center portion of completed metal pipe body;

pressing portions including edges of the plate towards center of the completed metal pipe body along the bottom surface of said portions including edges so as to get close contact of said edges and at the same time modifying said angles more than predetermined angle into said predetermined angle;

15 modifying said concave portion into convex form toward outside against center of the completed metal pipe accompanied with said angle modifying operation;

20 modifying said convex portion into flat by pressing said bottom surface and the surface facing to said surface with convex form towards center of completed metal pipe body with said portions including edges contacting together;

accumulating inner stress for said concave portions tending back to said convex form through said modifying operation by making said concave portions flat thereby making a close contacting operation of said portions including edges; and

25 maintaining said edges contacting together and said originally concave portion flat.

3. The method according to claim 1 or 2, wherein both ends of said flat metal plate are bent.

4. A method of manufacturing pipe body having a seam and circular shaped cross section made of a rectangular metal plate, comprising the steps of:

by bending said metal plate, forming a curved pipe-like intermediate product of oval-like cross section in which a pair of edges of said metal plate to be a seam of said pipe is still not contacted and located at one end of longer axis of said oval and extending along the axis of the completed pipe; and

10 modifying the curved intermediate product by applying a force along the longer axis of said oval so as to force said edges contacted tightly with spring back force tending to return to the original oval shape.

5. A method for manufacturing pipe body having a seam and polygonal cross section made of a rectangular metal plate, comprising the steps of:

15 by bending said plate at plurality of points along its edge direction, forming a pipe-like intermediate product in which a pair of edges of said metal plate to be a seam of said pipe are still not contacted together and both end angles of one specified wall are greater than the predetermined value for angle of the completed pipe;

20 making said pair of edges close contact by forcing said one specified wall convex to outside; and

modifying convex said one specified wall flat so as to force said edges contacted tightly with spring back force tending to return to the convex shape.

25 6. A method for manufacturing pipe body having a seam and polygonal cross section made of a rectangular metal plate, comprising the steps of:

a first processing step of forming a seam including wall by standing at

least one portion of a pair of edges of said metal plate along its edge direction;

a second processing step of forming remaining walls other than said seam including wall and making a pipe-like intermediate product in which a pair of edges of said metal plate to be a seam of said pipe are still not contacted and both  
5 end angles of one specified wall are greater than the predetermined value for angle of the completed pipe;

a third processing step of making said pair of edges close contact by forcing said one specified wall convex to outside; and

a fourth processing step of modifying convex said one specified wall flat so  
10 as to force said edges contacted tightly with spring back force tending to return to the convex shape.

7. An method according to claim 6, wherein the seam is located at the center of said wall including seam.

15

8. An method according to claim 6, wherein the seam is located between said wall including seam and adjoining wall.

9. A pipe body having a seam and polygonal cross section made of  
20 rectangular metal plate, characterized by:

being made through a pipe-like intermediate product prepared by bending said plate at plurality of points along its edge direction, in which a pair of edges of said metal plate to be a seam of said pipe is still not contacted and both end angles of one specified wall are greater than the predetermined value for angle of the  
25 completed pipe; and

said pair of edges are closely contacted by forcing said one specified wall convex to outside and convex said one specified wall are flat so as to force said

edges contacted tightly with spring back force tending to return to the convex shape.

10. An method according to claim 9, wherein a degree of closing of said seam  
5 based on spring back force when said one specified wall tends to return to the originally curved convex portion is greater than a degree of opening of the seam based on spring back force of said adjoining wall.

11. An method according to claim 8 or 9, wherein engaging portions are  
10 formed beforehand at portion to be said seam of said metal plate.

12. A method according to claim 6, wherein the shape of cross section of the pipe body is triangle, pentagon, hexagon, or octagon.

15 13. A method according to claim 6, wherein said one specified wall comprises a flat portion and a curved portion and said curved portion is formed between said adjoining wall and said flat portion.

14. A method according to claim 6, wherein the shape of cross section of the  
20 pipe body is rectangle, and an angle between the one specified wall of the intermediate product and the adjoining wall is an obtuse angle.

15. A method according to claim 14, wherein each of the walls of the pipe body includes a bottom wall defining each side of the rectangle, a pair of side walls  
25 adjacent to the bottom wall, and a upper wall facing to the bottom wall, and said seam is formed on said upper wall.

16. A method according to claim 14, wherein said metal plate includes engaging concave portion previously formed on the wall.

17. A method according to claim 14, wherein a forming process of said pipe  
5 body is performed under consideration of extension when bending the metal plate.

18. A pipe body having a seam and circular cross section made of rectangular metal plate, characterized by:

being made through a curved pipe-like intermediate product of oval-like  
10 cross section made by bending said metal plate in which a pair of edges of said metal plate to be a seam of said pipe is still not contacted and located at one end of longer axis of said oval and extending along the axis of the completed pipe; and

formed by modifying the curved intermediate product by applying a force along the longer axis of said oval so as to force said edges contacted tightly with  
15 spring back force tending to return to the original oval shape.

19. A pipe body having a seam and polygonal cross section made of a rectangular metal plate, characterized by:

being made through a pipe-like intermediate product prepared by bending  
20 said plate at plurality of points along its edge direction, in which a pair of edges of said metal plate to be a seam of said pipe are still not contacted together and both end angles of one specified wall are greater than the predetermined value for angle of the completed pipe;

said pair of edges are closely contacted by forcing said one specified wall  
25 convex to outside; and

convexed said one specified wall is modified flat so as to force said edges contacted together tightly with spring back force tending to return to the convex

shape.

20. A pipe body according to claim 19, wherein a degree of closing of said seam portion based on spring back force when said one specified wall tends to return to the originally curved convex portion is greater than a degree of opening of the seam portion based on spring back force of adjoining walls of said one specified wall.

21. A pipe body according to claim 18 or 19, wherein engaging portions are formed beforehand at portion to be said seam portion of said metal plate.

22. A prism pipe body having a seam extending along axis direction of said pipe body made of a rectangular metal plate, characterized by pair of edges of said plate consisting said seam are closely contacted by spring back force and having a fastening plate formed on a surface to be tied with other materials.

23. A prism pipe body according to claim 22, wherein said fastening plate is formed on the walls not including seam.

24. A prism pipe body made of a rectangular metal plate, comprising a bottom wall, a pair of adjoining walls to said bottom wall and upper walls one of which includes a seam confronting with said bottom wall, wherein:

said seam is closely contacted by spring back force;

said walls are extending along the direction of axis of the pipe body; and

a fastening plate is formed on a surface to be tied with other materials.

25. A pipe body according to claim 24, characterized by:

being made through a pipe-like intermediate product made of rectangular metal plate by bending said plate at plurality of points, in which said seam of said pipe is still not contacted and both end angles of said bottom wall are greater than the predetermined value for angle of the completed pipe; and

5           said seam is closely contacted by forcing said adjoining walls so as for said bottom wall to be convex to outside  
and said bottom wall is forced to be deformed.

26.       A pipe body according to claim 24 or 25, wherein said fastening plate is  
10       formed on said adjoining walls.

27.       A pipe body according to claim 24 or 25, wherein said fastening plate is  
protrudently formed on said bottom wall parallel to a direction in which said  
bottom wall extends, and the leading portion of it becomes a curved plate.

15

28.       A pipe body according to claim 22 or 23, wherein male and female  
engaging portions which engage with each other are formed on a wall including  
said seam.

29.       A prism pipe body made of a rectangular metal plate, comprising  
20       a bottom wall, a pair of adjoining walls to said bottom wall and upper walls  
including seam which is confronting with said bottom wall, characterized by

          a first residual stress distortion appeared at corners portion between  
said pair of adjoining walls and said bottom wall which makes said seam open,

          a second residual stress distortion appeared at center portion of said  
25       bottom wall induced by plastic deformation which has counter direction of said  
first residual distortion, wherein

          said seam is closely contacted by said second residual stress distortion



which makes said bottom wall convex to outside, and

an area exists between said corner and said center of bottom wall which has a low residual stress distortion.

5 30. A prism pipe body according to claim 29, wherein said area having low residual stress distortion is convex to outside.

31. A prism pipe body according to claim 29, wherein the inner side of said bottom wall becomes convex and concave by plastic deformation.

10 32. A prism pipe body characterized by:

being made through a pipe-like intermediate product comprising one specified wall, a pair of side walls adjoining to said specified wall and other walls, wherein:

the angles between said specified wall and said adjoining walls are obtuse,  
15 and said specified wall concave into inside;

a stress distortion toward inside generated on said intermediate product through making said specified wall convex to outside by deforming said pair of walls of said intermediate product toward inside;

forcing the angle between said specified wall and said pair of walls square  
20 by making plastic distortion so as for said specified wall to be deformed flat with making center portion of said specified wall as fulcrum, through forcing top wall including seam which is confronted to said bottom wall with restricting said pair of walls and making said intermediate product completed pipe body of which bottom wall corresponds to said specified wall and a pair of side walls adjoining said  
25 bottom wall correspond to said pair of side walls;

wherein said bottom wall deforms convex to outside by a residual stress distortion generated at center of said specified wall which has counter direction of

another residual stress distortion generated at corners between said pair of adjoining walls and said bottom wall making said seam open;

said seam is closely contacted by said another residual stress distortion;  
and

5            an area exists between said corner and said center of bottom wall having a low residual stress distortion.

33.        A prism pipe body according to claim 32, wherein said area having low residual stress distortion become convex extending to outside.

10

34.        A prism pipe body according to claim 30, wherein the inner side of said bottom wall becomes convex and concave by plastic deformation.